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Volatiles in the Outer Solar System

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Strategy

Telescopic data on asteroids, comets, planets, and planetary satellites are acquired and analyzed in the study of volatile ices and gases that occur on their surfaces and in their atmospheres. Infrared spectral studies of certain classes of asteroids for an analysis of their mineralogical and organic constituents are included in this work.

Progress and Accomplishments

Spectra of Triton were obtained at the NASA IRTF in 1990 and are being analyzed using new lab data on both methane and molecular nitrogen. Photometry of "asteroid" 2060 Chiron by me and my colleagues show comet-like activity of this body in the form of a brightness "outburst," since confirmed by others. The overall brightness of Chiron is diminishing at the present time. Thermal measurements of 20 μm were obtained in February 1990. Spectra of numerous asteroids in the range 0.8-2.5 μm were obtained in the search for mineralogical signatures of key asteroid types, and in the study of solid X-C≡N bearing surface materials. An absorption band identified as the first overtone of the X-C≡N fundamental has been found at 2.2-2.3 μm in the spectra of two comets, several D-type asteroids, and possibly in the rings of Uranus and the dark hemisphere of Iapetus; the data for the asteroids and Iapetus were obtained by Cruikshank and colleagues. Plans to obtain a new high-resolution IR spectrum of Io were thwarted by the catastrophic failure of a facility instrument at the IRTF in February 1991.

Projected Accomplishments

Further observations of Triton at maximum attainable resolution will be obtained. Further IR data on Chiron will be obtained to explore its cometary nature. High-resolution Io spectra will be obtained and analyzed. Pluto spectra will be analyzed. Spectra of Ariel will be obtained and analyzed. Observational and laboratory studies of the solid X-C≡N overtone band in the spectra of asteroids, comets, and other dark-surfaced bodies will continue with the use of the IRTF and lab facilities at Ames Research Center (L. Allamandola's lab).

Publications

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